Amendment, claims 22-34 are canceled and new claims 50-61 are added. No new matter is added to the application. Support for new claims 50-61 can be found throughout the specification as filed.

On January 24, 2003, Examiner Imam issued a telephonic Restriction Requirement wherein the Examiner requested that Applicants elect either Group I, claims 1-21 and 35-49, directed to methods and systems employing ultrasound or Group II, claims 22-34, directed to methods that do not explicitly recite ultrasound. The Examiner is thanked for the telephone interview on January 28, 2003 in which it was agreed that Applicants would elect Group I, claims 1-21 and 35-49, without traverse.

In accordance with the telephone interview of January 28, 2003, Applicants have canceled claims 22-34 without prejudice to their consideration in a later filed continuation, divisional or continuation-in-part application and added new claims 50-61 directed to further methods employing ultrasound.

With this Response to Restriction Requirement and Second Preliminary Amendment, Applicants believe that the present application is in condition for examination and respectfully request favorable consideration of the elected and newly added claims.

Respectfully submitted,

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PENDING CLAIMS FOLLOWING ENTRY OF THE SECOND PRELIMINARY AMENDMENT

1. A method for detecting a physiological property of a target tissue, comprising: noninvasively inducing a tissue displacement at a target tissue site by applying an ultrasound pulse; noninvasively acquiring data relating to the induced tissue displacement at or in proximity to the target tissue site; and relating the acquired data relating to the induced tissue displacement with a physiological property of the target tissue.

2. A method of claim 1, wherein the data acquired relating to the induced tissue displacement relates to an acoustic property of the target tissue.

3. A method of claim 2, wherein the data acquired relating to the induced tissue displacement is acquired by administering a plurality of acoustic interrogation pulses to the target tissue site and collecting acoustic data from the target tissue site.

4. A method of claim 2, wherein the data relates to at least one of the magnitude, amplitude and phase of acoustic scatter.

5. A method of claim 1, additionally comprising collecting acoustic data relating to the induced tissue displacement from the target tissue site using an ultrasound transducer operating in at least one of the following modes: transmission mode, reflection mode, scatter mode, backscatter mode, emission mode, echo mode, Doppler mode, color Doppler mode, harmonic or subharmonic imaging modes, a-mode, b-mode or m-mode; and correlating the acoustic data relating to the induced tissue displacement with a physiological property of the target tissue.

6. A method of claim 1, wherein the target tissue is CNS tissue.

7. A method of claim 1, wherein the target tissue is CNS tissue, and the physiological property detected is intracranial pressure.

8. A method of claim 1, wherein the target tissue is CNS tissue, and the physiological property detected is cerebral perfusion pressure.

9. A method of claim 1, wherein the target tissue includes or is in proximity to a blood vessel and the physiological property detected is arterial blood pressure.

10. A method of claim 1, wherein the target tissue is CNS tissue, and the physiological property detected is selected from the group consisting of: vasospasm, stroke, local edema, infection, vasculitus, subdural or epidural hematomas, subarachnoid hemorrhages, ischemic conditions, multiple sclerosis, Alzheimers disease, hypoxic conditions, intracerebral hemorrhage, tumors and other intracranial masses, and acute, chronic and traumatic conditions and injuries.

11. A method of claim 1, wherein the target tissue is heart tissue, and the physiological property detected is abnormal heart tissue.

12. A method of claim 1, wherein the target tissue is peripheral nervous system tissue.

13. A method of claim 1, wherein the data relating to the induced tissue displacement is acquired using a detection technique selected from the group consisting of: near infrared spectroscopy (NIRS), optical coherence tomography (OCT), magnetic resonance techniques, and positron emission tomography (PET).

14. A method of claim 1, additionally comprising comparing the acquired data relating to the induced tissue displacement with an empirically determined standard.

15. A method of claim 1, additionally comprising acquiring multiple data sets, each data set relating to the induced tissue displacement at different points in time relative to the application of the acoustic radiation force.

16. A method of claim 1, additionally comprising inducing tissue displacement at a second target tissue site different from the first by applying a second ultrasound pulse, acquiring

data relating to the induced tissue displacement at or in proximity to the second target tissue site, and comparing the acquired data relating to the tissue displaced at the target tissue site with the acquired data relating to the tissue displaced at the second target tissue site.

17. A method of claim 1, wherein the target tissue is CNS tissue, and wherein the data acquired relating to the induced tissue displacement relates to an acoustic property of the target tissue, additionally comprising conducting an initial environmental assessment to evaluate the characteristics of the environment between an acoustic source and the target tissue site.

18. A method of claim 1, additionally comprising acquiring data relating to intrinsic tissue displacements at the target tissue site at multiple time points over the course of at least one cardiac cycle, and correlating the acquired data relating to the intrinsic tissue displacements and the induced tissue displacement at the target tissue site with a physiological property of the target tissue.

19. A method of claim 1, additionally comprising applying a plurality of different ultrasound pulses to the target tissue site and acquiring data relating to the tissue displacements induced by the different ultrasound pulses.

20. A method of claim 1, additionally comprising applying a plurality of ultrasound pulses to the target tissue site at a plurality of times and acquiring data relating to the induced tissue displacements.

21. A method of claim 1, additionally comprising applying a plurality of ultrasound pulses to a plurality of target tissue sites and acquiring data relating to the induced tissue displacements at the plurality of target tissue sites.

35. A method for assessing a physiological parameter of a target tissue comprising: applying focused ultrasound and inducing oscillation of the target tissue; measuring a property of an acoustic signal emitted from the target tissue; and relating the property of the emitted acoustic signal to a physiological tissue property.

36. A method for monitoring intracranial pressure (ICP) in a subject, comprising: administering acoustic interrogation signals to a target CNS tissue site in the subject; acquiring acoustic scatter data from the target CNS tissue site; determining the arterial blood pressure (ABP) of the subject; and relating the acquired acoustic scatter data and ABP with ICP.

37. A method of claim 36, additionally comprising relating the acoustic scatter data to the stiffness or elasticity of the target CNS tissue and relating the stiffness or elasticity of the target tissue with ICP.

38. A method of claim 36, additionally comprising comparing the ICP and ABP and determining the autoregulation status of the patient.

39. A system comprising an acoustic source and an acoustic detector, the acoustic source and detector being operably connected to a power source, the power source being operably connected to a function generator, and the function generator being operably connected to a controller having data acquisition, storage and analysis capability, the controller having the capability to process acquired acoustic data and relate acquired acoustic data with at least one physiological tissue condition, and the controller being operably connected to a display device for displaying information relating to at least one physiological tissue condition.

40. A system of claim 39, wherein an acoustic source and an acoustic detector are provided as an ultrasound transducer.

41. A system of claim 39, comprising multiple ultrasound transducers.

42. A system of claim 41, wherein the multiple ultrasound transducers are annular.

43. A system of claim 39, wherein an acoustic source and detector is provided as a transcranial Doppler device.

44. A system of claim 39, wherein the display device provides information relating to the ICP, ABP and autoregulation.

45. A system comprising a focused acoustic source capable of providing targeted acoustic pulses in combination with an imaging device capable of imaging the spatial location of the targeted acoustic pulse.

46. A method for localizing a physiological condition or biological response comprising: administering ultrasound pulses to a plurality of targeted tissue sites and acquiring data relating to the physiological condition or biological response induced by the ultrasound pulse(s) at each of the targeted tissue sites.

47. A method of claim 46 wherein the physiological condition or biological response is pain and data is acquired by observing the subjective sensation of pain induced, or not, upon application of an ultrasound pulse to each of the targeted tissue sites.

48. A method of claim 47 for localizing the source of pain in a joint.

49. A method of claim 47 for localizing a source of pain and diagnosing a condition selected from the group consisting of: appendicitis, cholecystitis, pelvic inflammatory disease, lymphadenopathies, anthrax infection, and peripheral nerve-related conditions.

50. A method for assessing a physiological property of a target tissue, comprising the steps of:

(a) acquiring acoustic data relating to intrinsic tissue displacements at a target tissue site at multiple time points over the course of at least one cardiac cycle; and

(b) relating the acoustic data with a physiological property of the target tissue,

wherein said acoustic data is collected by using an ultrasound transducer.

51. The method of claim 50 wherein said ultrasound transducer operates in at least one of the following modes: transmission mode, reflection mode, scatter mode, backscatter mode, emission mode, echo mode, Doppler mode, color Doppler mode, harmonic or subharmonic imaging modes, a-mode, b-mode or m-mode; and correlating the acquired acoustic data relating to intrinsic tissue displacement with a physiological property of the target tissue.

52. The method of claim 50, further comprising the step of acquiring acoustic data relating to intrinsic tissue displacements at multiple target tissue sites at multiple time points over the course of at least one cardiac cycle.

53. The method of claim 50 wherein the acoustic data acquired relating to the intrinsic tissue displacement at the target tissue site relates to acoustic properties of the target tissue.

54. The method of claim 53 wherein said acoustic properties of the target tissue are selected from the group consisting of changes in the amplitude of acoustic signals, changes in phase of acoustic signals, changes in frequency of acoustic signals, changes in acoustic emission signals, changes in length of scattered signals relative to an interrogation signal, changes in maximum and/or minimum amplitude of an acoustic signal within a cardiac cycle, the ratio of the maximum and/or minimum amplitude to that of the mean or variance of subsequent oscillations within a cardiac cycle, changes in temporal or spatial variance of scattered signals at different times in the same location and/or at the same time in different locations, and rates of change of tissue displacement or relaxation.

55. The method of claim 50 wherein said acoustic data relating to said intrinsic tissue displacement at the target tissue site is acquired by administering acoustic interrogation pulses to the target tissue site and collecting acoustic scatter data.

56. The method of claim 55 wherein said acoustic scatter data is acquired at a single acoustic frequency.

57. The method of claim 55 wherein said acoustic scatter data is acquired at multiple acoustic frequencies.

58. The method of claim 50, further comprising the step of relating the intrinsic tissue displacement data and additional data relating to blood pressure, cardiac and/or respiratory cycles, to a physiological property of said target tissue.

59. The method of claim 50 wherein said target tissue is selected from the group consisting of CNS tissue, heart tissue, and peripheral nervous system tissue.

60. The method of claim 50 wherein said target tissue includes or is in proximity to a blood vessel and wherein the physiological property detected is arterial blood pressure.

61. The method of claim 58 wherein said target tissue is CNS tissue and wherein said physiological property of said CNS tissue is selected from the group consisting of intracranial pressure, cerebral perfusion pressure, vasospasm, stroke, local edema, infection, vasculitus, subdural or epidural hematomas, subarachnoid hemorrhage, ischemic conditions, multiple sclerosis, Alzheimers disease, hypoxic conditions, intracerebral hemorrhage, tumors and other intracranial masses, and acute, chronic and traumatic conditions and injuries.